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Patent Application for:

WIRELESS STREAMING AUDIO SYSTEM

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7 **WIRELESS STREAMING AUDIO SYSTEM**  
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10 **FIELD OF THE INVENTION**

11 This invention relates generally to the field of audio systems. More  
12 particularly, this invention relates to methods and apparatus for providing remote  
13 storage of audio files and wireless streaming audio playback.  
14

15 **BACKGROUND OF THE INVENTION**

16 Storage devices for storing electronic data such as music files have steadily  
17 decreased in size and cost while increasing in storage capacity over the years.  
18 Such devices as Compact Discs, and flash memory cards such as the Sony  
19 Memory Stick™ have made it possible to store high quality audio files for playback  
20 very conveniently by the user. However, it remains impractical for the user to take  
21 full advantage of a library of music using such storage mechanisms while  
22 remaining mobile. Even with the smallest and most dense storage media, a  
23 substantial library of music is impractical to carry around with the user. This is  
24 especially true if the user is traveling on foot, bicycle or using public transportation  
25 where storage space and convenience can become a major limitation to the  
26 amount of music that one can readily carry. This is particularly true if the user is  
27 carrying a music player along with a personal digital assistant, cellular telephone  
28 and other possessions.  
29

## SUMMARY OF THE INVENTION

The present invention relates generally to audio systems. Objects, advantages and features of the invention will become apparent to those skilled in the art upon consideration of the following detailed description of the invention.

In certain embodiments consistent with the present invention a wireless streaming audio system and method is provided. A user subscribes to a service for storage of music files on a server at a data center. The music files may be uploaded from the user or obtained by the data center from a commercial music source. The user may play back the stored music at a wireless music player by requesting transmission of the music by the data center. The data center then provides a wireless transmission of streaming audio data to the music player for real time or near real time playback. The music player is freed of the need for local storage of music files and may be readily incorporated into a cellular telephone or other wireless communication device. In other embodiments, the music player may be implemented as a stand-alone music player device.

A method consistent with an embodiment of the invention, includes storing a music file for a user; receiving a request from the user for playback of the music file; and transmitting the music file to the user for playback, using wireless transmission, as a streaming music file. The method may further include receiving from the user a request to store the music file; and wherein the storing is carried out as a response to the request to store the music file.

An electronic storage medium storing instructions which, when executed on a programmed processor, carry out a method consistent with an embodiment of the invention including storing a music file for a user; receiving a request from the user for playback of the music file; and transmitting the music file to the user for playback, using wireless transmission, as a streaming music file.

A data center consistent with an embodiment of the invention includes a content server that stores music files for plurality of users. A request is received from the user for playback of the music file. The music file is transmitted to the user for playback, using wireless transmission, as a streaming music file.

1 Preferably, the data center receives from the user a request to store the music file,  
2 and wherein the storing is carried out as a response to the request to store the  
3 music file.

4 A music player consistent with an embodiment of the invention includes a  
5 wireless receiver for receiving transmission of streaming data. A streaming audio  
6 decoder, coupled to the wireless receiver decodes the streaming data into analog  
7 audio signals. An audio circuit converts the analog audio signals into audible  
8 sounds. The music player may also have a user interface that receives user  
9 commands, and a wireless transmitter for transmitting the user commands to a  
10 data center to direct the data center to transmit the streaming data.

11 A method of operation of a wireless music player, consistent with an  
12 embodiment of the invention, includes receiving a user input for playback of a  
13 music selection; transmitting a request to a data center for the music selection;  
14 receiving a streaming data file representing the music selection; decoding the  
15 streaming data file to produce an audible representation of the music selection; and  
16 playing the audible representation of the music selection for the user.

17 The above summaries are intended to illustrate exemplary embodiments of  
18 the invention, which will be best understood in conjunction with the detailed  
19 description to follow, and are not intended to limit the scope of the appended  
20 claims.

## 21 22 **BRIEF DESCRIPTION OF THE DRAWINGS**

23 The features of the invention believed to be novel are set forth with  
24 particularity in the appended claims. The invention itself however, both as to  
25 organization and method of operation, together with objects and advantages  
26 thereof, may be best understood by reference to the following detailed description  
27 of the invention, which describes certain exemplary embodiments of the invention,  
28 taken in conjunction with the accompanying drawings in which:

1           **FIGURE 1** is a block diagram illustrating a system for remote storage of  
2 music files and wireless playback by streaming audio according to an embodiment  
3 consistent with the invention.

4           **FIGURE 2** is a flow chart illustrating a process consistent with an  
5 embodiment of the invention.

6           **FIGURE 3** is a block diagram of a music player consistent with an  
7 embodiment of the present invention.

### 8 9                           **DETAILED DESCRIPTION OF THE INVENTION**

10           While this invention is susceptible of embodiment in many different forms,  
11 there is shown in the drawings and will herein be described in detail specific  
12 embodiments, with the understanding that the present disclosure is to be  
13 considered as an example of the principles of the invention and not intended to limit  
14 the invention to the specific embodiments shown and described. In the description  
15 below, like reference numerals are used to describe the same, similar or  
16 corresponding parts in the several views of the drawings.

17           Turning now to **FIGURE 1**, a block diagram of a system for remote storage  
18 of music files and wireless playback by streaming audio according to an  
19 embodiment consistent with the invention is shown as 100. In the embodiment  
20 illustrated, system 100 provides a customer with the ability to store personally  
21 owned music or music from a commercial music source 104 (e.g., a record  
22 company or recording artist) at a data center 108 for playback at a later time from  
23 any suitable location on a music player 110 using a wireless transmission of  
24 streaming audio. In accordance with this embodiment, a user may own rights to  
25 music (e.g., by purchase or by his or her own creation) that the user stores on  
26 electronic storage media within, or playable on, his or her personal computer  
27 system 116. In order to conveniently have access to this music, the user can utilize  
28 a wireless device incorporating a music player 110 (e.g., a dedicated personal

1 music player, a PDA, a cellular telephone device or a multifunction device  
2 incorporating the music player).

3 In this embodiment, the customer (the terms "user", "subscriber" and  
4 "customer" can be used somewhat interchangeably herein) subscribes to a service  
5 provided by the data center 108 for storage of his or her personal library of music.  
6 The customer (or approved users) can then upload music files for storage to the  
7 data center 108 via the Internet 120. At the data center 108, these music files are  
8 stored on a content server 124 for future access by the user.

9 When the user wishes to play back the music stored at content server 124,  
10 a request is sent to the data center, preferably by the music player 110 using  
11 wireless communication, through a nearby transmitter/receiver site 130 which may  
12 be coupled to the data center 108, for example, through a wireless data network  
13 136 (which may include wired and wireless connections) such as a cellular  
14 telephone network or other similar infrastructure. When the data center 108  
15 receives a valid request for playback, the content server 124 streams real time or  
16 near real time audio back to the user through the wireless network 136 and nearby  
17 transmitter/receiver site 130 to the music player 110. The music player may then  
18 play back the audio in real time or near real time, thus providing the user with  
19 access to this music at any location within range of an appropriate transmitter  
20 receiver site 130.

21 In another variation of the invention, the user may not only upload music  
22 from a personal library as just described for remote wireless access, but may also  
23 use the content server 124 at the data center 108 for storage of music files provided  
24 by a commercial music source 104 such as a record company. In this  
25 embodiment, the user requests that the data center 108 obtain and store a  
26 particular music selection. The data center 108 then requests the music from a  
27 suitable commercial music source 104 and obtains the files via an electronic  
28 transfer from the music source 104 for storage on content server 124. The data  
29 center 108 then pays royalties to the commercial music source 104 (or to a royalty  
30 agent) and passes along fees to cover the royalties on to the subscriber. Since the

1 data center 108 may purchase rights to a particular selection for numerous  
2 subscribers, they may be able to obtain reduced royalty rates that can result in  
3 savings that may be passed on to the subscriber. Also, since multiple users may wish  
4 access to a particular selection, the music selection need only be stored once in  
5 content server 124 with access to the selection mapped to users who contribute to  
6 the royalties (or are otherwise entitled to access the selection, e.g., by virtue of a  
7 flat rate subscription). Any number of fee structures can be devised for the  
8 implementation of various embodiments of the present invention.

9 The actions of the data center 108, as will be appreciated by those skilled  
10 in the art, are preferably implemented using a programmed processor forming a  
11 part of, or connected to, content server 124. The program steps for carrying out the  
12 data center 108 actions may be stored on any suitable electronic storage medium.

13 In accordance with the embodiment illustrated in **FIGURE 1**, the  
14 transmitter/receiver site 130 may be part of a cellular telephone or other wireless  
15 telephone network (or a data network or other communication network) and the  
16 streaming audio may be provided by any suitable Wireless Application Protocol  
17 (WAP) that is able to support a suitable data rate for acceptable quality audio.  
18 However, other wireless communication arrangements can be used including blue  
19 tooth for use in smaller areas (e.g., a home network) or using a dedicated wireless  
20 network may be provided for distribution of the data. As will be seen later, the  
21 circuitry required to implement the present invention at the music player 110 may  
22 be a minimal addition to many existing electronic communication devices such as  
23 PDAs and cellular telephones, lending itself to easy incorporation into such devices  
24 to not only eliminate the need to carry a collection of stored music, but also to  
25 eliminate the need to carry a separate player.

26 The process described above is illustrated as process 200 of **FIGURE 2**  
27 starting at 204. At 208, a customer subscribes to a music storage and streaming  
28 service provided by the data center 108 as illustrated in **FIGURE 1**. From the  
29 customer perspective, the services of the data center 108 and the music player 110

1 are idle until the customer makes a request at 212. If the request is to store music  
2 at 216, the customer request for music storage is sent to the data center 108 at  
3 220. The data center 108 receives the request at 224 to store an audio selection  
4 for the customer. At 228 the data center 108 stores the music files for the  
5 customer. The files can be received either from a customer download or obtained  
6 from a commercial music source such as 104. The customer may then (depending  
7 upon the subscription arrangement) be charged a fee by the data center 108 based  
8 upon the amount of data, or number of files or other criteria for data storage. If  
9 such a fee is charged at 234, it is accumulated in the customer subscription for the  
10 next billing cycle at 208 and the system awaits the next customer request at 212.

11 If the request at 216 is not for storage of music files, control passes to 240  
12 to determine if the request is to playback music. If the request is for music  
13 playback at 240 the customer request is sent to the data center 108 at 244. The  
14 data center 108 receives the request to streaming audio selection to the customer  
15 at 248. Assuming the customer request is valid, the data center 108 sends  
16 streaming audio files via a wireless channel to the customer at 252. At the music  
17 player 110, the music player 110 receives the streaming music file and plays back  
18 the music for the customer at 258 in real time or near real time. The customer may  
19 again be charged based on usage at 264 (depending upon the subscription  
20 arrangement) which is accumulated in the next customer subscription billing cycle  
21 at 208. In the event the request at 240 is not for playing music, other request  
22 handling such as account management may be handled at 270.

23 Referring now to **FIGURE 3**, an embodiment of a wireless music player 110  
24 is illustrated. In this embodiment, only the circuitry used for the music player 110  
25 is illustrated. However, those skilled in the art will appreciate that music player 110  
26 may be incorporated within a cellular telephone or other device without departing  
27 from the invention. Music player 110 includes a wireless transmitter/receiver 304  
28 that receives and transmits data through an antenna 308. When receiving  
29 streaming music data, wireless transmitter/receiver 304 passes received data to  
30 a streaming audio decoder 312 for decoding. Streaming audio decoder 312 may



1 decode compressed streaming audio files such as MP3 or ACC files. Streaming  
2 audio decoder 312 may incorporate or utilize a separate cache memory 316 to  
3 facilitate providing continuous music to the user in the event of momentary  
4 dropouts in the wireless transmission. Moreover, streaming audio decoder 312  
5 may be implemented as either hardware or software without departing from the  
6 present invention.

7 Decoded streaming audio from streaming audio decoder 312 is passed to  
8 an audio amplifier circuit 320 which in turn drives one or more audio transducers  
9 such as those incorporated in headphones 326 to provide the user with audible  
10 music. Music player 110 also incorporates a suitable user interface 340 coupled  
11 to a control processor 344 such as a microprocessor having associated program  
12 memory 350. When the user wishes to control the playback or send a request to  
13 the data center 108, the user does so utilizing the user interface 340. Such a  
14 request is then processed by the processor 344 and passed on to transmitter  
15 portion of all of wireless transmitter/receiver 304 for transmission using antenna  
16 308. Control processor 344 may also be utilized to effect various controls over the  
17 wireless transmitter/receiver 304, streaming audio decoder 312 and audio amplifier  
18 circuit 320, and may be interconnected thereto, for example, using a multi-wire bus  
19 arrangement as illustrated.

20 Those skilled in the art will appreciate that music player 110 includes a  
21 plurality of components that may already be present in some form within various  
22 electronic devices such as a PDA or a cellular telephone. In general, streaming  
23 audio decoder 312 (implemented as either hardware or software) and modifications  
24 to the user interface 340 and a control program stored in program memory 350  
25 could be the major modifications required to certain existing electronic devices in  
26 order to implement the present invention.

27 Those skilled in the art will recognize that the present invention has been  
28 described in terms of exemplary embodiments based upon use of a programmed  
29 processor within the music player 110 as well as the data center 124. However,  
30 the invention should not be so limited, since the present invention could be

1 implemented using hardware component equivalents such as special purpose  
2 hardware and/or dedicated processors which are equivalents to the invention as  
3 described and claimed. Similarly, general purpose computers, microprocessor  
4 based computers, micro-controllers, optical computers, analog computers,  
5 dedicated processors and/or dedicated hard wired logic may be used to construct  
6 alternative equivalent embodiments of the present invention.

7 Those skilled in the art will appreciate that the program steps used to  
8 implement the embodiments described above, at both the data center 108 and the  
9 music player 110, can be implemented using various forms of storage including  
10 Read Only Memory (ROM) devices, Random Access Memory (RAM) devices;  
11 optical storage elements, disc drives, magnetic storage elements, magneto-optical  
12 storage elements, flash memory, core memory and/or other equivalent storage  
13 technologies without departing from the present invention. Such alternative storage  
14 devices should be considered equivalents.

15 The present invention is preferably implemented using a programmed  
16 processor executing programming instructions that are broadly described above in  
17 flow chart form and can be stored on any suitable electronic storage medium.  
18 However, those skilled in the art will appreciate that the processes described above  
19 can be implemented in any number of variations and in many suitable  
20 programming languages without departing from the present invention. For  
21 example, the order of certain operations carried out can often be varied, and  
22 additional operations can be added without departing from the invention. Error  
23 trapping can be added and/or enhanced and variations can be made in user  
24 interface and information presentation without departing from the present invention.  
25 Such variations are contemplated and considered equivalent.

26 While the invention has been described in conjunction with specific  
27 embodiments, it is evident that many alternatives, modifications, permutations and  
28 variations will become apparent to those skilled in the art in light of the foregoing  
29 description. Accordingly, it is intended that the present invention embrace all such

1 alternatives, modifications and variations as fall within the scope of the appended  
2 claims.

3 What is claimed is:  
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